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HIGH-SPEED SHEAR FOR TRANSVERSE CUTTING OF A ROLLED STRIP

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a high-speed shear for transverse cutting of a rolled strip to a length and including a first upper blade drum having a comparatively large diameter and carrying a first blade, a second lower blade drum having a comparatively small diameter and carrying a second blade, and a drive transmission for rotationally connecting the first and second blade drums, with the first and second blade cooperating with each other in a predetermined cutting position of the first and second blade drums for cutting the rolled strip.

2. Description of the Prior Art

Generally, high-speed shears for transverse cutting a rolled strip to a length are well known. Thus, German Publication DE 197 46 528A discloses a high-speed shear having two drums one of which carries a chisel cutter and the other of which carries an anvil that cooperates with the chisel cutter for cutting the strip. A controlled adjusting device displaces the two drums toward each other for cutting a run-through strip. The synchronization of the displacement

of the two drums is effected by using electrical, electronic, and mechanical means.

European Publication EP 0 904 877A2 discloses a high-speed shear with blade drums the diameters and speeds of which differ only insignificantly, and which are driven by an external divider mechanism. The drums are brought into a cutting position, in which the blades are located opposite each other, by a lever-operated setting mechanism and, after cutting the strip, the drums are moved away from each other.

German Publication DE-OS 26 54 866 discloses a flying shear with blade drums rotationally connected with each other. The disclosed shear has a drum rotating device with a force transmitting mechanism that connects the two drums and insures that their speeds are synchronized with the running speed of the fed material. This German Publication further discloses a drum adjusting device for displacing the drums between an open position and a cutting position, and a control unit for controlling the motor of the adjusting device and which controls the displacement of the drums between the open and cutting position.

In the shear disclosed in DE-OS 26 54 866 the ratio of the diameters of the first and second drums in equal 2 to 3, and their rotation is so coordinated that the second drum performs two revolution per three revolution of the first drum. The drum setting or adjusting device is so controlled that the first and second drums are in the cutting position after six revolutions of the first drum and four revolution of the second drum.

As it follows from the disclosure of DE-OS 26 54 866, in particular Fig. 2, the force transmitting mechanism, which connects the drums, the drum adjusting device, and the control unit are very complicated and are failure-prone. The force transmitting mechanism has five tooth gears engaging each other so that the accumulated tooth backlash results in deviation of the angular positions of the blade drums for predetermined positions which can lead to the damage of the shear and also result in an unclean cut.

Accordingly, an object of the present invention is to provide a high-speed shear for cutting hot and/or cold strips which would insure obtaining of a precise cut with the strip being transported with a high speed.

Another object of the present invention is to provide a high-speed shear for cutting hot and/or cold strips which would insure obtaining of a precise cut of strips having minimal thicknesses and transported with high-speeds.

A further object of the present invention is to provide a high-speed shear having a simple structure and non-complicated mechanical and/or electronic mechanisms.

A still further object of the present invention is to provide a high-speed shear in which the danger of the blades or even entire shear being damaged is eliminated.

Yet another object of the present invention is to provide a high-speed shear having reduced mounting and maintenance costs.

SUMMARY OF THE INVENTION

These and other objects of the present invention, which will become apparent hereinafter, are achieved by providing in a high-speed shear of the type described above:

(i) means located in front of and behind the first and second drums for advancing the rolled strips, under longitudinal tensioning, through a gap between the first and second drums, and

(ii) roller means for supporting the tensioned strip and providing for lifting of the strip beforé passing of the second blade and for lowering the strip before passing of the first blade.

In the shear according to the present invention, the drums can be accelerated to the strip advancing speed by an increase of their rotational speed. This is indispensable at large strip speeds, e.g., of order of 20 m/sec and more.

The novel features of the present invention, which are considered as characteristic for the invention, are set forth in the appended claims. The invention itself, however, both as to its construction and its mode of operation, together with additional advantages and objects thereof, will be best understood from the following detailed description of preferred embodiments, when read with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings show:

Fig. 1 a schematic view of a high-speed shear according to the present invention;

Fig. 2 a side view of a shear drum pair in different angular positions during their rotational movement;

Fig. 3a a front, partially cross-sectional view of a shear blade drum; and

Fig. 3b a side view of the drum pair according to Fig 3a.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A high-speed shear according to the present invention for transverse cutting a rolled strip to a length, a schematic view of which is shown in Fig. 1, has a first blade drum 1 having a comparatively large diameter, and a second blade drum 2 having a comparatively small diameter. The first and second blade drums 1 and 2 are rotationally connected by a gear transmission (not shown) so that a number of X-revolutions of the first blade drum 1 corresponds to a number of Y-revolutions of the second blade drum 2, whereby the first and

second blade drums 1 and 2 are brought into a cutting position after different but finite numbers of X-revolutions and Y-revolutions, respectively.

According to the invention, the blade drums 1 and 2 are fixedly secured in respective bearing supports in a shear frame 3. The shear further includes pinch-roller sets 4, 5, which are arranged in front and behind the blade drum pair 1 and 2 for advancing the strip 10, under longitudinal tensioning, through a gap between the first and second blade drums 1 and 2. The shear also has support rollers 6, 6' for supporting the strip 10 during its advance. The support rollers 6, 6' lift the strip 10 before the lower blade 7 (Fig. 3b) passes and lowers the strip 10 when the upper blade 8 passes through the cutting position.

The foregoing measures insure in a simple manner that during an "idle run" of the upper, first blade drum 1 and the lower, second blade drum 2, corresponding blades 7 and 8 do not contact the strip 10. To this end, there is provided a corresponding electrical, electronic, or mechanical repeating and synchronization device for displacing the support rollers to 6, 6' to effect lifting or lowering of the strip 10.

According to an embodiment of the present invention, which is shown in Fig. 3a, the first and second blade drums 1 and 2 are fixedly connected with synchronization tooth gears 9, 11, respectively, having respective diameters roughly corresponding to the blade diameters 12, 13 of respective blades 7, 8. The synchronization gears 9, 11 engage each other backlash-free.

Obviously, as *per se* known, the first and second blade drums 1, 2 can be connected with respective drive shafts by a transmission (not shown) which would provide a different transmission ratio than the synchronization gears 9, 11.

The upper, first blade drum 1, on which the blade 8 is mounted, is noticeably flattened at the periphery opposite the blade diameter 12. Therefore, the shear can be brought into a position in which a large opening or gap is formed between the drum 1 and the upper edge of the roll table along which the strip 10 is advanced. A large opening is needed, during entering and passing through of the strip head, as the strip head, for bending up of the front end, is inclined, in a manner of a ski, and with a smaller gap, the strip can be damaged in the region of the shear.

In order to reliably prevent such a possibility, the upper drum 1 is replaced with a blade beam support 1' having the same blade diameter 12. The blade beam support 1' is formed as a beam bridge 16 with two opposite shaft stubs 15, 15', as shown in Fig 3a.

There is further provided *per se* known, hydraulic or mechanical drive or adjusting means for displacing the support rollers 6, 6' and the operation of which is synchronized with passing of the upper and lower blades 8, 7 through the blade gap between the drums 1 and 2. This means insures upward and downward displacement of the support rollers 6, 6' together with the tensioned strip 10 supported thereon. Due to the elevated arrangement of the support rollers 6, 6' which can be seen in Fig. 1, the strip 10 is supported thereon under a compressive strain, which insures that the strip 10 can follow the support rollers 6, 6', during the downward movement of the support rollers 6, 6' without any problem.

According to a further advantageous embodiment of the inventive shear, instead of the blades 7, 8, there are provided, preferably a cutting bit on the upper drum 1 and an anvil on the lower drum 2. The advantage of providing a cutter bit and an anvil consists in that the tolerances in the relative angular

positions of the cutter bit and the anvil do not adversely affect the quality of the cut, and a clean and burr-free cut is obtained.

According to the present invention, the drums 1 and 2 are rotationally preloaded with respect to each other and/or the tooth backlash of the gears 9, 10 is minimized and/or compensated. E.g., the tooth gear 9, which is formed as a pinion, can be radially divided, and respective portions can be rotationally preloaded relative to each other in order to compensate the tooth backlash.

Fig. 2 shows different phases of positions of the blade supports 1', 2, which rotate with different speeds, relative to each other. Only once, they occupy a cutting position, which is determined by a transmission ratio defined by a predetermined number of revolutions of each of the drums 1' and 2, and, thus, provide a gap, after or before the cut, for the rolled strip 10.

Due to the obtained transmission ratio between the two drums 1, 2, in an acceleration phase of rotation of the two drums 1, 2, an increase of their speeds to that of the advancing speed of the rolled strip, before the cut step, up to their cut position became possible.

Though the present invention was shown and described with references to the preferred embodiments, such are merely illustrative of the present invention and are not to be construed as a limitation thereof and various modifications of the present invention will be apparent to those skilled in the art. It is there not intended that the present invention be limited to the disclosed embodiments or details thereof, and the present invention includes all variations and/or alternative embodiments within the spirit and scope of the present invention as defined by the appended claims.